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NOTES ON THE COMMENSALS FOUND IN  
THE TUBES OF *CHÆTOPTERUS*  
*PERGAMENTACEUS*.

H. E. ENDERS.

WHILE I was collecting *Chætopterus pergamentaceus* during the past summer on the shoals about Beaufort,<sup>1</sup> North Carolina, I became interested in the commensals which occur with this annelid, and their number and variety led me to study their habits.

These annelids, which grow in broadly U-shaped parchment tubes, are imbedded in diatomaceous, sandy shoals with from two to five centimeters of their free slender ends (about seven millimeters or less in diameter) protruding above the sand flats at or below low-tide level. These tubes serve as convenient temporary shelters for several species of small animals, and as the permanent abodes of others.

Of ninety-nine tubes collected and opened eleven were found without commensals while the remaining eighty-eight enclosed two annelids of the genus *Nereis* also one hundred and seventy-six crabs of the species<sup>2</sup> *Polyonyx macrocheles* (formerly *Porcellana macrocheles*), *Pinnixa chætoptera*, *Pinnotheres maculatus*, and one species of "stone crab," *Menippe*.<sup>3</sup> *Polyonyx* and *Pinnixa* are found either singly or together in the same tube, but usually in pairs, male and female, of a single species. Among the number of tubes collected seventy-five enclosed *Polyonyx* in pairs or singly (total 143); fifteen enclosed *Pinnixa*; two, *Pinnotheres*, and one, a "stone crab," *Menippe*, while two serpulids,

<sup>1</sup> I am indebted to the Hon. Geo. M. Bowers, U. S. Commissioner of Fish and Fisheries, for the privilege of occupying a table in the Fisheries laboratory at Beaufort, N. C., and to Dr. Caswell Grave, the director, for courtesies shown.

<sup>2</sup> I am also indebted to Miss Mary J. Rathbun, of the U. S. National Museum, for the identification of the species of crabs.

<sup>3</sup> The specimen was mislaid or lost at Beaufort, N. C.

encrusted on a female *Pinnixa*, may be regarded as an accidental enclosure.

The tubes of *Chætopterus* are not the only abodes of some of the commensals named: *Nereis* is found among the shells, rocks and sea-weeds; *Pinnotheres maculatus*, in the shells of *Pinna semi-nuda* like the related species, *P. ostreum*, in the oyster; whilst *Menippe* commonly keeps in hiding in crevices and pits in rocks and shells. So far as I know, *Polyonyx macrocheles* and *Pinnixa chætopterana*, beyond the young stages, are only very rarely found free on the shoals, but *Polyonyx ocellata* is found at Beaufort on the body of *Limulus*, and sometimes in old shells dredged outside the harbor.

The sizes of the crabs range from two millimeters in width to that of the full-grown animal (thirteen to fourteen millimeters wide), and the smallest ones are of such a size that they could readily pass through the orifices of the tubes, and they probably do so for I have frequently collected tubes with two adult crabs and a single small one but rarely with three full-grown individuals.

The position of the crabs in the interior of the tubes I learned by keeping the *Chætopterus* and crabs in glass U-tubes, to, the open ends of which the annelids constructed inverted parchment funnels, which prevented their escape. While the commensals move about with rapidity they remain at one end of the U-tube, usually the one opposite that occupied by the annelid itself, but when the annelid reverses its position they press past it to the opposite end and there remain bathed in the passing current. The annelids, *Nereis*, moved along the dorsal wall of the tube and did not interfere with *Chætopterus* which occupied the ventral portion of the tube.

The commensals, which are usually found near the orifices of the U-tube, are advantageously located for securing food, which, if it consists either of vegetable matter or of copepods and various larvæ which pass through the tube in the moderate current of water, and the worms that may seek shelter in the tube, is very abundant.

The commensals are permanently confined within the tubes of *Chætopterus* where the breeding is comparatively simplified

because of the presence, in nearly every instance, of male and female in the same tube. I also found tubes containing males only (4) or females only; among the latter the eggs on seven females (six *Polyonyx* and one *Pinnotheres*) thus taken were in various stages of development, while two other females had, just a short time before capture, liberated their broods. The mature male of *Pinnotheres* is small enough to pass into and out of the orifices of the tubes, but how or when the eggs of the isolated individuals of *Polyonyx* are fertilized remains an open question.

The breeding season of the two more common commensals, *Polyonyx* and *Pinnixa*, extends through the whole summer. Females with eggs in all stages of development, together with females which had just liberated their broods, were taken in my first collection, June 21st (1904), and even in my last collection, October 25th, every full-grown female taken bore developing eggs, or had very recently liberated her brood as shown by the few imperfect larvæ clinging to the pleopods, or by the position of the abdomen, or "apron," not being closely appressed to the body. At the time of the last collection the breeding season of *Pinnixa* must have been near its close but that of *Polyonyx* continued unabated.

The larvæ do not long remain in the tubes after they are hatched but soon find their way out and they may then be taken in the tow in considerable numbers from June till November.

Young crabs, not over two or three millimeters in width, are found in the tubes during the middle and latter parts of the breeding season, but they are frequently overlooked because of their tendency to press between the appendages or the folds of *Chætopterus* and hide there. In this manner four young crabs, about two millimeters wide, were overlooked when four tubes were opened, and from each the worm together with two full-grown commensals were removed, and only after the worms were submerged in the killing-fluid did the activity of the crabs make their presence known. Once in the tubes it is quite probable that the crabs remain there and are later prevented, through their own growth, from escaping.

The act of moulting was not observed in these commensals but recently moulted individuals of *Polyonyx* were taken on

three occasions, the "shells" of which, more or less nearly complete, were still in the same tube with the "soft-shelled" crabs.

When a worm in a tube dies the crabs in the same tube die as a result of the failure of food and properly aerated water. Two tubes were taken in which this might have occurred as was shown by the nearly perfect condition of the extremities of the tubes and by the presence of the bodies of three dead crabs lodged in the necks of the tubes, which were only recently filled with sand.

Whether or not commensalism is an advantage to *Chætop-terus* it seems to be a decided benefit to the crabs, *Polyonyx* and *Pinnixa*, grown specimens of which are *rarely* found outside the tubes. The advantage to the crabs is very clearly marked by their prolonged breeding season—virtually an example of protected industry.

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December, 1904.